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ABSTRACT

In September 1982, a science school began operation at the Ontario Science Centre to provide programs, personnel, facilities, and resources to help students achieve their potential in physical, intellectual, emotional, social, cultural, and moral development, especially as these relate to scientific knowledge and to the needs of society. This report is an evaluation of the school's program. Since the school has been in operation for a relatively short time, the focus of the study is primarily on the perceptions of the students and teaching staff regarding the extent to which they feel the program is achieving its purpose and meeting their expectations. The perceptions of Science Centre resource staff and administrators, however, were also obtained. Information was collected by means of interviews and/or questionnaires. Findings indicate that the school is a success in terms of the academic and personal growth of students. The unique environment, excellent staff, and the very special and close relationships which are fostered encourage the kind of development in students which is much desired but rarely achieved in regular high schools. Several problems (and related suggestions) are noted. However, these are not considered serious enough to hamper the school's operation. (Copies of research instruments used in the study are appended.) (JN)

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THE ONTARIO SCIENCE CENTRE SCHOOL

Perceptions of Students, Teaching Staff, Resource Staff and Administrators

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Patricia Crawford

January 1984

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Our thanks also to Michael Bayer, a Science School student, who took the photographs which appear in this report.

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INTRODUCTION

Establishment of the Ontario Science Centre School

On 15 April 1980 a meeting was held with Ontario Science Centre personnel, representatives from the East York and North York Boards of Education, and the Ministry of Education to discuss the establishment of a Science School at the Ontario Science Centre. The purpose of this school would be to provide programs, personnel, facilities, and resources to help students achieve their potential in physical, intellectual, emotional, social, cultural, and moral development, especially as these relate to scientific knowledge and to the needs of society. A decision was made to support the concept and, in December 1980, the Advisory Council of Directors of the Metropolitan Toronto School Board was approached to request its support. Final approval was given on 23 February 1982 for the Science Centre School to begin operation in September 1982 under the jurisdiction of the North York Board of Education and, for administrative purposes, as part of Don Mills Collegiate Institute.

The goals for the school are threefold:

- To provide a unique science enrichment opportunity for senior high school students from across the province through the use of the human and material resources of the Ontario Science Centre.
- To foster an interest in the communication of science and thereby, in the long run, significantly improve general science literacy.
- To combat a declining interest in the study of science, particularly at the high school level, by offering a challenging alternative.

Description of the School

Admission Requirements and Procedure

The program is open to any student in Ontario who is qualified to enrol in Year V. Enrolment is limited to a maximum of 30 students each semester. Candidates make written application and must demonstrate not only above average ability and interest in science and mathematics (minimum marks of 75% in these subjects), but are expected to have an inquiring mind, be socially mature, have some leadership qualities and experience, and a strong desire to study in an environment with students sharing a similar interest in science.

As can be seen from the application form (Appendix A) a rating is assigned to numerous personal, academic, social and emotional characteristics. These ratings are tallied and are considered along with the academic standing of the candidates. Those who pass the initial screening are invited to attend a small group interview, usually with five other candidates. Two interview teams are set up drawn from all Science School staff members, the Guidance Head of Don Mills C.I. and the two class presidents from the previous year. The candidates are seen by both groups of interviewers and consensus is sought on those who will be granted admission.

Courses

Five courses are offered in each semester--Chemistry, Physics, Biology, Algebra, and Science Communication. The first four meet the requirements of current Ministry curriculum guidelines. The latter is an experimental course, and is recognized as an English credit by the Ministry of Education.

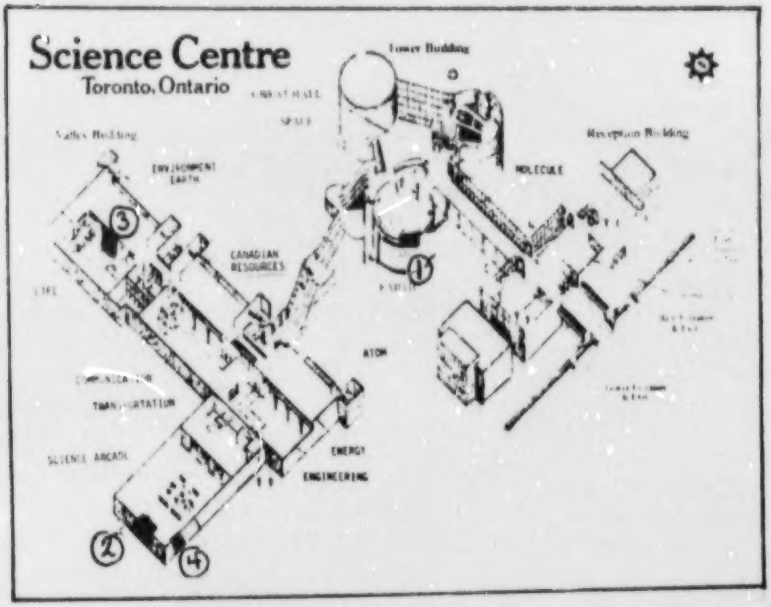
In all courses there is an emphasis on the acquisition of the processes and skills of science and mathematics through inclusion of elements such as experimentation, correlational analysis, comparative analysis, logical analysis, decision making, and critical reading.

Students usually take three or four courses though one student, in the first semester of this year, took all five.

Teaching Staff

The staff consists of five teachers. Three are permanent members of the Science Centre's Educational Department and teach Communication, Algebra and Physics. The other two teachers are seconded from Metropolitan Toronto School Boards for two-year periods to teach Chemistry and Biology. The rotation is arranged so that only one teacher is replaced each year. Wide use is also made of other human resources at the Centre, mainly the science, design, audiovisual and library staff.

Facilities



Facilities are shared with the Science Centre's Education Department. Ordinary classroom and laboratory facilities are in short supply and there is a considerable amount of improvisation. Extensive use is made of the theatres (1), laboratories (2), special equipment available at the Centre such as the electron microscope (3) and the rotating room (4).

The existence of these special facilities enables students to see demonstrations and undertake experimentation which would not be possible in a regular high school setting.

THE STUDY

Purpose of Evaluation

The Science Centre School has been in operation for three semesters over a period of one and a half years. Seventy-three students have been in the program to date. The Science Centre, the Advisory Council of Directors of the Metropolitan Toronto School Board and the North York Board of Education requested an evaluation of the Science Centre School in order to determine the program's success. Educational Research and Evaluation Services of the North York Board of Education was approached by the Evaluation Sub-Committee of the Steering Committee of the Science Centre School to assist in the evaluation.

The Evaluation Procedures

Since the program has been in operation for such a short period of time, the focus of the study was primarily on the perceptions of students and teaching staff regarding the extent to which they feel the program is achieving its purpose and meeting their expectations. The perceptions of Science Centre resource staff and administrators

were also obtained. Information was collected from each of these groups by means of personal interviews and/or questionnaires.

Students

The 26 students attending the Science Centre School in the first semester of 1983-84 were interviewed in groups of three to eight. The interviews took place during November 1983 and lasted for about one hour. Information was recorded during the interviews by means of audiotape and notes compiled by one of the researchers. At the conclusion of the interviews students were asked to complete a written questionnaire which posed questions not included in the interviews. It also gave students an opportunity to comment anonymously on matters about which they may have felt constrained in the group interview. Nineteen of these questionnaires were returned.

The opinions of the forty-four former students were gathered by means of a questionnaire which was mailed late in November 1983. Thirty questionnaires were completed and returned by this group of students. Copies of the interview schedule and the questionnaire may be found in Appendices B and C.

Additional data were obtained from student applications and from final marks earned in grades 11, 12, and 13.

Teaching Staff, Resource Staff and Administrators

Individual interviews lasting approximately half an hour were held with one former teacher, the five current teachers and a number of Science Centre personnel, including both administrators and resource staff. The administrators interviewed included the Director General, the Chief of Design, the Chief of Education, the Chief of Finance, the Chief of Science and the Senior Audiovisual Technician. The resource group consisted of an audiovisual technician, the biologist in charge of the electron microscope laboratory, the librarian, and a member of the chemistry department. The Principal and Guidance Head of Don Mills Collegiate Institute were also interviewed.

These interviews were fairly open-ended. For teaching staff, the focus was on perceptions of student learning, enrichment aspects and effectiveness of the program, personal satisfaction, problems encountered and changes they would recommend. Interviews with resource staff and administrators were primarily related to the individual's contact with the students, perceptions of the effectiveness of the program, impact of the program on the Centre, and recommendations for change. See Appendices D, E, and F for copies of the interview schedules.

THE FINDINGS

The Student's View

In response to the interviews and questionnaires students spoke about a variety of topics:

- the characteristics needed for success at the School
- why they choose to attend
- what expectations they had and how those expectations were met
- their teachers and courses
- their personal and academic growth
- their relationship with peers, teachers and resource staff
- the facilities and atmosphere
- attendance patterns
- participation in Science Centre Host programs and in extracurricular activities
- their semester preference
- the screening process
- what affect the Science School has had on their future plans
- how they adjust to returning to high school or entering university.

The main ideas expressed by students about each of these topics are presented on the following pages. Verbatim quotes from both the interviews and the questionnaires are used extensively to illustrate the various themes.

As there was little difference between responses of first and second year students they are reported together.

Profile of Students

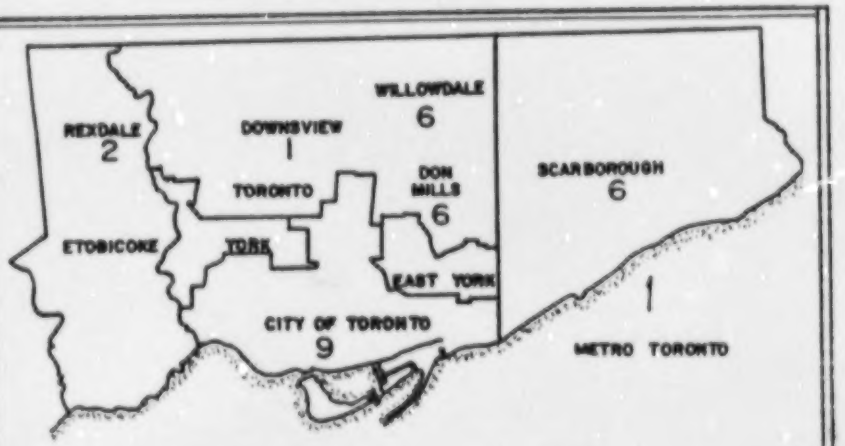
Students see this program as designed to attract people who are good academic achievers (though not necessarily gifted in science), mature, self-motivated, flexible, open, questioning, outgoing, friendly and doers. On the whole, their backgrounds attest to this. Typically, they have been among the top achievers in their class, have a wide range of intellectual and recreational interests both in and out of school, have spent summers working or travelling, have community volunteer experience, and demonstrate leadership ability either in school or in the community. There have been a few exceptions, particularly in the first year when the screening process was not as stringent and all students who applied and agreed to come were offered places.

As can be seen from the maps on page 6, about two-thirds of the students come from the Metro Toronto area and the rest are drawn from many other parts of the Province.

SCIENCE CENTRE SCHOOL

STUDENTS' HOME TOWNS

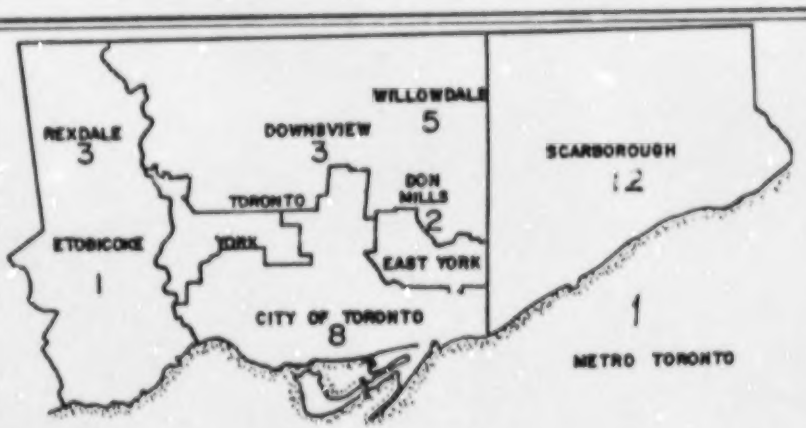
1982-83



47 students

Metro	30
Outside Metro	17

1983-84



50 students

Metro	34
Outside Metro	16

Slightly more than half the students are female, unusual for a Grade 13 science program. The responses to our question about why the male-female ratio is so different at the Science Centre School were enlightening. Several of the girls had attended all girls' schools where they were encouraged to study math and science.

. I didn't like the stereotypes in coed schools so I switched to an all girls' school where we were encouraged to study math and science.

Others said it was unusual for girls to continue the study of more than one grade 13 science subject, usually biology, and that it was socially uncomfortable to do so.

. In my school very few girls take all math and science subjects; it's not true here.

. Girls didn't participate in the math contests even when they were good because they didn't want to appear too smart.

. Any girl who took math and science was considered freaky.

Most of these girls are sufficiently mature and highly motivated so that they were not deterred from pursuing their own interests by social pressures and they are pleased that the screening process did not exclude them.

The males were very supportive of their female peers but also stressed how unusual it is to have so many girls in their science and math classes.

. Generally more males are interested.

. In my school, of the top nine science students, eight were male, one female.

. It's different here. We accept each other. Girls take the same courses, work just as hard and do as well.

Asked in the interviews about what characterized a successful student, the students replied:

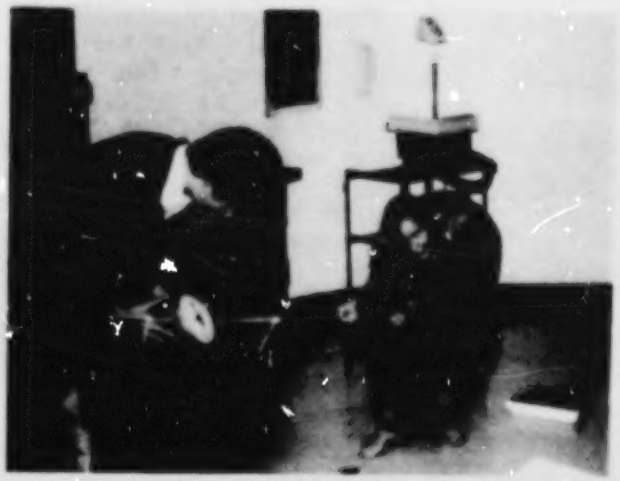
. You have to be an above average student to start.

. You've got to be outgoing, friendly and compatible because you have to work with people. You open up so much more here.

. It's necessary to be self motivated because you're not spoonfed here.

. A strong cooperative feeling is necessary because we work together on solving problems.

- It helps to be tough and a little bit crazy.
- And above all, you've got to be flexible.



Why the Science Centre?

Students are drawn from many parts of the province for a variety of reasons:

- by curiosity,
- dissatisfaction or boredom with traditional science courses,
- a desire for a different and challenging experience,
- the opportunity to "do science" rather than just learn about it,
- a longing to be among peers who are their intellectual equals and who share their interest in science.

Most compellingly, however, they are attracted to the Science Centre itself.

Effective enrichment programs undoubtedly exist in other contexts, but the Science Centre is a unique environment. This uniqueness is apparent even to a casual visitor. There is a sense of excitement when one enters this architecturally dramatic collection of buildings which is devoted exclusively to providing a better understanding of science and technology for its visitors. Many of the students were aware of this and recognized that the synergistic effect of exposure to many dimensions of science and technology, the availability of special facilities, as well as access to an exceptionally rich resource of human talent and experience in a variety of disciplines could not be duplicated in the regular school system. The existence of this environment was central to their decision to apply.

- The environment here is special; I've been here before and I learn here. I was always attracted to it.
- The science program at my school wasn't very good. I wanted a change. You have to come here and see the place to get inspired.
- There was a chance for hands-on experience because we would have access to the tremendous facilities available, the electron microscope, rotating room, laser collection, and spectroscope.
- I was encouraged by the philosophy of the program and thought it would provide a learning opportunity I wouldn't get anywhere else. It would be different from anything else I ever had.

- I'd been in small enriched classes with exceptional teachers before but they always had too many other responsibilities and were not always accessible.

- I was bored and thought Grade 13 a waste of time so I applied to go to university at the end of Grade 12 and was accepted. I also applied here and was undecided about which to choose until after the interview and talking to former students. I realized that this would be an experience I couldn't get at university.

- I was looking for self discipline, a better environment and thought the motivation would be greater in an environment where everyone wants to learn and everyone is interested in science.

- I was always interested in science but not sure which field. I thought the practical approach here would help me sort it out.

The Academic Challenge

There is no question that these students get more than they expect and in directions they do not always anticipate. Academically they are challenged as most have never been before. In addition to the regular Grade 13 material which must be covered, the program includes a strong, practical problem solving approach designed to utilize the special resources available at the Science Centre. Teachers expect the students to do the "book learning" on their own. There are no standard texts. Students are encouraged to check as many references as possible, both in the Centre's library and through outside resources such as the Metropolitan Reference Library. Lab experiments are usually open-ended, based on a question posed. Students must design and carry out experiments on their own. They are also expected to choose projects in each of the courses in keeping with their own interests, to deal with concepts in-depth, and to work both independently and in cooperation with other students in solving problems. Many feel overwhelmed at first:

- I was in a state of shock. We were no longer spoonfed.

- We weren't handed everything on a silver platter - the teacher didn't set everything up for us. We had to do it ourselves. It was tough.

There is no doubt that they rise to the challenge. Almost all of the students interviewed or surveyed feel they have experienced a great deal of academic growth as a consequence of their attendance at the Science Centre School. They speak of real learning, challenge,

excitement, exposure to new ways of thinking and learning, increased initiative and creativity, improved research skills, stimulation for self learning, recognition of originality, improved work habits and better management of time.

- Here you are challenged and forced to work. We learn by doing. For the first time we learned practical applications of science.

- My childhood curiosity, depressed by years of structure, was awakened. "Why" was not a taboo question.

- I have learned more about science in two and a half months then I learned in all my years in high school. We go into concepts in depth and gain real understanding.

- There is real learning, not memorization; you have to think; I never had to do that before.

- We learned much and were exposed to many things that we would never have had the opportunity to experience in high school. I think the environment really stimulated my interest in science and challenged me to learn and remember better.

- Compared what we're doing with friends in regular school and we've already done more than they do in the whole year.

- I found my freedom in all the courses to be exciting in terms of learning.

- I learned skills I can use in the future.

- I'm learning to be more creative, to do more than is asked. I'm more prepared to use my own initiative, to look for help and solutions instead of waiting for them.

- Am learning to do research well by using the resources at the Centre and those outside, e.g. Metro Reference Library, University.

Students attribute the explosion of learning to the interaction of a number of factors - the content and method of teaching courses, the availability of special facilities and expert resource people, the special quality of student-student and student-teacher interaction, the small size of classes, and the Science Centre environment and organization. First and foremost, however, they pay tribute to a superb teaching staff who stimulate and challenge them to question, think, and do for themselves.

<u>On Teachers and Courses</u>

The excellence of the teaching staff was commented on by all students. They find the teachers challenging, interesting, exciting and helpful, as well as very successful in communicating their enthusiasm for their subjects. The students feel the courses provide exposure to new ideas, both in terms of course material and method of teaching. There is a great deal of emphasis on independent learning, which they find exciting and valuable.

The inclusion of regular Science Centre teachers on the school staff had an interesting and unexpected by-product in the stimulus to independent learning. Both the physics and math teachers were sent on a month's assignment for the Science Centre to the Far East early in the first semester of 1983-84, the consequence of large sales to China and Japan of replicas of major exhibits. When the students got over the shock of realizing they would be without these teachers for about a fifth of the semester, they discovered they were capable of learning on their own as their comments below indicate.

The following are typical of comments made:

(a) On teachers

- Has got to be the most innovative and exciting teacher I've ever seen; he is so comprehensive and good. His ideas really put the subject into a perspective I could understand.
- Is so enthusiastic that you can't help but be excited.
- Forces the class to search deep inside for answers and not look for easy ways out.
- Is very demanding and I respond to that.
- Made the subject clear for me.

(b) On course content and mode of learning:

- For the first time I saw the relationship between math and science/ The mini projects provided a new view of math, not just formulas/ It was exactly like university and gave me a good idea of what to expect/ We're teaching ourselves algebra because the teacher is away. At first no one understood what it was all about. Then we went through the stuff step by step and as people began to understand something they explained it to everyone else. We all kind of talked about it and came away saying this is easy/ I learned that I could teach myself math.
- There were many demonstrations in biology and I loved the greenhouse, "pickled" babies, film on birth/ I learned a lot from having to take on the role of a famous biologist, explain what it was like to be living in his times, and defend his ideas/ You have to study theory on your own but there's lots of practical experience, e.g. in the section on bacteriology we set up tests and were able to examine the results with the electron microscope and the spectometer.

- It's really challenging to have to research, design and carry out a chemistry experiment by yourself/ Experiments were more in-depth than in high school; plenty of equipment and less step-by-step instruction so that you had to think about the concepts introduced and their conclusions. We did many, many experiments and the reports we wrote up really demonstrated to us what we needed to know about organization and the topic researched.

- In communication we have been shown new ways of looking at things; not just through print. The design experience in this course really makes you think/ Communication in science was something I had no experience with before and in which I could see practical applications to the "real world"/ It gets you very involved with different non-verbal communication, such as mime and audiovisual and you can see the need to choose the way you present the material to suit the audience/ It's a fantastic course which should be part of every grade 13 curriculum. I learned how to relate to all different kinds of people in different kinds of different ways.

- In physics we didn't just memorize formulas, we were expected to understand them on an intuitive level; learned to look at knowledge taken for granted and question it/ I could relate it to real life/ We were often given experiments to do which simply consisted of a question. We were to devise an experiment, obtain the equipment, do the experiment, write a lab report. I loved the freedom and creativity required/ We were given an assignment on the first day of our physics class to design a clock that measures milliseconds and then the teacher left for China for a month. We were devastated; have to build this clock and we haven't got a clue. We began to discuss what to do. Then all different ideas came out. It was great!

On Resource People and Other Science Centre Staff

The accessibility and quality of interaction with other Science Centre personnel is an added bonus which is well appreciated. They serve as valuable reservoirs of information with many of them, including the Director General, giving lectures on aspects of their fields of specialization. Many also offer friendship and support, both academic and personal from the much loved EM lab head (who acts as an unofficial guidance counsellor and confidant), to the people in the shops who cheerily, though unofficially, fill student requests for materials.

- I spent a lot of time getting to know other staff members chiefly for reference sources. I found them to be very helpful and generous with their time and genuinely interested in any question or problem I had.

- It took me awhile to realize I could approach staff in the chemistry, physics, A/V and the other departments with problems or ideas I wanted to try [and] found a whole new resource. Much of my learning involved working on non-course projects on equipment in the chemistry or A/V departments. Gave me courage to approach people at the University of Toronto, Royal Ontario Museum and other institutions as well.

- They give lectures on topics of interest. They help us with assignments and many of them are just great to talk with. Some are very friendly. We go to them with questions regarding school or just to talk.

- They're my friends and very supportive when I need it, especially the EM lab head - you can talk to him about anything, he's so understanding.

- Staff and security are quick to pick up the names and personalities of students. The staff go out of their way for us and we try to please them. I definitely know that I will miss people such as the head of the EM lab.

- All the guys back in the workshop are great. They will help cut up 25 pieces of wood to our dimensions, give us brushes and paint. The A/V people borrowed a camera and taught us how to make film.

In the first year, about 30% of the time of some of the resource people was assigned to provide assistance to students. This year there has been a reassignment of duties within the Centre's staff which has eliminated the time allocated for helping the students. However, this change has not been a tremendous barrier for them. With the delightful arrogance of youth they do not hesitate to approach the people from whom they want help.

- They're great. They are there for brainpicking. We don't have any sense of interrupting them. Feel it's okay to do so unless we're warned not to. I don't care - it's important and we don't bother them all the time.

- We know the resource people would love to help us but it's hard on them because when they give us time they still have to do their own jobs.

Despite students' generally positive feelings about Science Centre staff, there were some difficulties in the first year. Some of the students said they sensed resentment to their presence from some staff members.

- Many of the other staff resented us, especially the older staff, because we were the "whiz kids" who were coming in and taking over "their" show.
- Some didn't like us collectively. I don't know why.
- It depended on staff members. Some were friendly on the outside but we could tell they were not interested in having us there.
- There was a rash of thefts from the Centre last year and Security tended to blame the students because they were the new element.

This year, however, there appears to be a change in attitude. None of this year's students feel there is any problem with Centre staff. In fact, they speak fondly of the help they receive from them, particularly from the Security staff which is benevolently tolerant and supportive allowing them access to the Centre at almost anytime and accepting delivery of pizzas when they stay late to work in labs or study.

The Librarian is also very much appreciated, both because of her assistance and advice in finding needed materials, and because she recognizes the need of students to have a place to relax.

<u>On Environment and Facilities</u>

While the students regard the environment as unique and conducive to learning, and the special facilities as exciting, the physical facilities allotted are often less than ideal and draw mixed ratings.

- The environment here is special. The major problem is not enough time. It is like being in a candy store and you want to taste everything but you can't. I'd love to explore everything downstairs.
- The rotating room is especially good; in other schools they see these experiments on video; we get a chance to experience them directly.
- It's great to be allowed to work here whenever you wish. It's marvellous to have access to labs at any time because there isn't another class using them. I like to work weekends when no one else is around.

- It's incredible. You can use any of the special facilities; if you need them - electron microscope, spectographs, rotating room, variety of lasers.

- There are higher level projects here and more motivation. You feel challenged to do more, make better use of what's around here.

- The facilities are here and we adapt to the situation, but it's frustrating not to have needed supplies. We have to scrounge stuff and we've learned to improvise.

- We need space to sit, work, study. The lounge area is small and we have to share it with the Centre's hosts.

- There is also the problem of repair of special equipment. It seems to be a low priority if it's for school use.

- On the whole we have more special facilities available, but everyday stuff is hard to come by such as enough glassware for chemistry, specimens for biology; no analytical balance is available.

<u>On Personal Growth and Relationships</u>

The tone for the kind and quality of relationships which develop is set at the beginning of the semester. The first day of school is spent at the Science Centre and then students and staff go off for a two-day Communications Workshop conducted by the Guidance Co-ordinator of the York Board of Education. In the first year this was held at Glen Park, the Professional Development Centre for North York. In September 1983, the two days were spent in residence at Boyd Conservation Area. This workshop provides a framework in which the participants get to know each other, identify and focus on their own and the others' strengths, examine the quality of their participation in groups, and learn the importance of listening skills.

During the workshop students feel they are melded together making them, in their words, "a family". They speak of this time as one of the highlights of their Science Centre experience. It was apparent during the interviews that they have come to care for, respect and protect each other. They jokingly speak of being interchangeable, having the same interests and tastes, even to the extent of liking the same kinds of food. The sense of being a small, cohesive, group fosters an enrichment which extends beyond the classroom. They discuss not only science but anything of interest - philosophy, music, art, life.

The support proferred by staff and fellow students, combined with a challenging environment, new ways of seeing and thinking about things, and intense student and mature teacher-student relationships contribute to a strong sense of personal growth.

- I have experienced a strong sense of personal growth because of the different learning environment. Any change is an opportunity for personal growth. I found I was challenged more than usual.

- I'm much more responsible both academically and personally as I live away from home.
- Have become more independent and self confident; at the same time I've learned to work much better with others.
- The school provided a situation where you had to rely on yourself and were not spoonfed by teachers.
- The school has broadened our horizons whereas normal school stifles our abilities.
- Our limits are tested where high school never does that, you found out how much you really could do. We were more on our own, interacting with administration dealing with more problems and obstacles than would normally encountered. I have gained personal confidence in dealing with others.
- I've learned better discipline, work habits, and organization of time; have learned to work harder, think more.
- I learned a lot about public relations working with new people, older people and as a unit with people.

- I developed new ways of interacting with people - fellow students and teachers. I learned to trust and work with other students and the benefits involved in discovering their interests outside of school/ personal growth came from the closeness and special friendship we shared - teachers and students alike.

- It was a definite positive experience. No high school could have even matched it. NONE!! My reasoning has become sharper as a result of constant questioning and challenging in the work presented to me.

Teacher-Student Relationships

For a few of the students there has been no change in their perceptions of teacher-student relationships, but for most of them it has been a revelation to discover that teachers are human, approachable and can make learning a pleasure.

- The first name basis at the Science School was an absolutely fantastic idea. It made the staff much more approachable. Formality such as titles, professor or doctor, no longer inhibit me from approaching people. I am on first name basis with my profs and less afraid to approach them.

- The one-to-one relationship was great! Thanks! I especially liked the first name basis. Teachers elsewhere always seem to have a godly aura. They seem more human now.

- Have never had such open lines of communication between myself and my teachers before this semester. Teachers are more willing to discuss project ideas. Relationship with them is much more personal and two-way. We can discuss anything we want with them, academic or personal.

- Teachers are "real people" in comparison to the person who sort of teaches and hands out tests and exams. They are considerate of our individual schedules, extra-curricular activities or other problems.

- They treat us as adults. We are given more responsibility and the staff's trust in us helps us grow. They guide us toward the right answers rather than giving it to us. They respect us.

- I now realize how much teachers have to put up with and can better understand how they work. I also know how much better some teachers could be.

- Teachers don't throw the rules at you. They treat you as an adult. They expect us to be responsible for our assignments and don't badger us.

- I can be more critical of my teachers, their attitudes towards students and their teaching styles (in most cases it's spoon feeding). I have also made the effort to get to know my teachers in a more personal manner as a result there is mutual respect between us.

Student Relationships

During the interviews we were struck by the number of times students referred to the nature and quality of their relationships with each other. They spoke with a great deal of feeling about the effectiveness of the "getting to know you" communications weekend in making them more open, more aware of their own and other people's strengths and in bringing them together. These students are very aware that they are privileged to be in a small, special school with people of similar interests and motivation.

- Previously I was not with students who shared the same interests. At the Science Centre School I met students who were all interested in science as well as having other very diverse interests. They were open and willing to discuss anything and everything and shared insights on subjects I would normally only discuss with adults elsewhere.

- The social atmosphere is so different. In an average class less than 10% of students have the same interest level as you. Here we can have meaningful, stimulating conversations outside of class, as well. For example, someone did a presentation on the heart in biology and posed a number of questions. The debate on these questions continued throughout the day with different people taking up the argument as they came out of class into the lounge. You're stimulated to use your brain as you never have before. This kind of exchange has encouraged me to look at science with more depth and interest.

- In my old school I knew very few people because it was so large. Here you know everyone well and there is a good feeling of comradeship. It makes school worth coming to.

- I have become much closer to other students much faster than I normally would have. It's great; many new friends possible because of the small number of students. You get to know and appreciate people better. The class plans many activities. There is more socialization because you have a chance to know everyone better.

- Everybody is more open, there are better relationships. People are more helpful and support each other a lot. There is more discussion because we are a small group and strong friendships develop.

- I've become more open, less scared of people and I dislike school less than ever before. I'm less shy and communicate better with other people.

- Students here are terrific and interaction with them is proving to be an important part of this entire experience. They are part of the learning experience here. It's taught me that I will always need people. I still consider myself independent but it is a great feeling when you come to realize just how important relationships with colleagues really are.

- I now enjoy discussing relevant topics with my peers and I've started to learn how to get people interested in something they may not have been interested in before. I now realize my classmates are a very good source of information when I'm stuck on a problem.

Problems of Adjustment

Initially, there are a number of problems in adjustment stemming from both academic and personal pressures, for example, being in a new environment, finding a place to live, living away from home, missing their friends, and experiencing a change in learning and teaching styles which often results in lower marks. A number of students said they experienced a sense of bewilderment or displacement, or felt they had some difficulty in adjusting at first, but that these feelings did not persist for long.

Students who commute from outlying districts find travel time a nuisance but worth the effort: "It's a long trek (two hours) but I can live with it". Most who travel long distances say they use this travel time to study and have become quite innovative in reading and writing on buses or trains.

Other problems mentioned were fairly individual - an allergy to concrete dust (the Centre is constructed of concrete), having to learn to cook for oneself, and having to be more independent both at school and at home.

There is a decided increase in pressure on the majority of these students. Although much of it is self generated, they also feel pressure from peers, staff, parents, the environment, and the much heavier work load. The effects of increased and sustained pressure are seen as a positive factor by most students, though it obviously takes its toll on others.

- The pressure is beneficial. It made me strive for greater success. I feel I must always achieve in every aspect of life. I wanted to prove to myself I could succeed without external pressure.

- In the beginning it was a desire to fulfil expectations of the teaching staff. Later it became my own desire to work in such a demanding manner.

- The pressure came from my own desire to get good marks. Also a sense of competitiveness which is healthy and provides incentive. It prepared me better for university.

- It's made me think seriously about whether I can handle the university work load.

- All my personal habits have changed (less sleep, no exercise, change of eating habits)

- Had to prove my acceptance was worth it. There was pressure from everyone because we were the best in Ontario and were expected to excel.

- I was expecting a lot of competition for marks but found it really was non-existent.

- Pressure came from self, peers, staff and parents. Pressure from myself and parents has always been a factor; peer pressure affected me positively, but I found staff pressure very hard to cope with.

- Feel pressure from the staff of my old school; that I need to do well for them.

- The pressure from within depressed me at the beginning of the term, but I learned to rise to the challenge and then took pride in the work I was able to complete.

- The pressure from self, staff and environment has created problems in my life, but I am learning how to deal with stress.

- My parents worry over the drop in marks. I also have difficulty in accepting lower marks.

- I was in a state of shock at first because I was behind in my knowledge of the subjects and I didn't know what I was supposed to do.

These students are accustomed to being among the top achievers in their classes and it is a tremendous shock to them when they experience a substantial drop in marks. This is not an unusual occurrence as the concentration on independent and in-depth learning frequently results in students not completing all the work required or not getting the right answers at first.

- I used to get 90's without working. Now am getting only 65 and working as hard as I can. It was hard moving from "doing very well" to being downright average.
- Most of us are used to getting high marks and not working hard. When all of a sudden your marks drop 40% it is a shock. It's an eye opener.
- I was a little worried about marks because of university entrance. We were told not to worry about marks, but to concentrate on the experience. Mind you we want to do well.
- We have to come to terms with the fact that marks are not as important as the learning that takes place.

Despite their concerns, student marks usually have returned to their high levels by the end of the semester as can been seen in Table 1 below.

TABLE 1

Comparison of Marks Obtained in Grade 11 and 12 by 1982-83 Students with Similar Subjects Taken in Grade 13 at the Science Centre School

Grade	Total No. of Students	Subject	Percentage						
			50-59 No. of Students	60-69 No. of Students	70-79 No. of Students	80-89 No. of Students	90-100 No. of Students	Range	Mean
12	20	English	-	4	4	8	4	66-92	79
13	47	Communication	-	-	14	27	6	70-92	82
12	29	Mathematics	-	-	4	16	9	72-100	87
13	28	Algebra	3	6	4	10	5	52-100	77
12	23	Chemistry	1	1	3	12	8	50-100	85
13	38	Chemistry	2	1	14	11	11	51-97	81
12	35	Physics	-	1	10	12	12	65-100	84
13	42	Physics	3	2	11	17	9	50-97	81
12	-	-	-	-	-	-	-	-	-
13	15	Biology	1	1	3	7	3	58-96	81

Attendance Patterns

There is little change in general attendance patterns when they come to the Science Centre because most of these students have always attended school and classes regularly. Any change that occurs is, in fact, in the opposite direction since, for the first time, some students feel they have the freedom not to attend classes.

- I actually skipped some classes at the Science Centre - all to my educational benefit. I might have been working on a problem with other students - whatever the reason I learned that it is possible to get more value for my time even if I missed a class. I wish I had realized this before the Science Centre. In my home school I often found classes unprofitable and became adept at doing other work during class, whereas at the Centre no class missed was unprofitable, simply less profitable.

- I actually skipped some of the communication classes near the end of the semester. This is one thing you don't do at the school I went to.

Whereas regular attendance in high school is frequently based on compulsion, at the Centre School students attend classes because they find them interesting and stimulating and don't want to miss what's going on.

- Classes were interesting and no one wanted to skip. I have more desire to attend.

- I attend all classes because they are stimulating as well as necessary; more time is spent on topics of interest. I was afraid of missing something special.

- Attendance here is good. We're here weekends and late at night. You don't go to school on a weekend anywhere else. People are here because they want to be.

The above is also true for students who confess to having skipped classes in the past.

- Classes are more interesting, valuable, and important. I used to skip frequently.

- If nothing new was being taught in a particular (usually boring) class I would occasionally skip to do homework, etc. This never applies to the Science Centre.

Regular attendance is obviously not a problem. The real change lies in the amount of time students spend at the Centre. For many it is home-away-from home. They arrive early, stay late, and frequently come in on weekends to study, use the lab facilities, or to work with other students on assignments.

Science Centre Host Programs

The educational process is considered a two-way street and students are encouraged to participate on a voluntary basis in the other program activities at the Science Centre. The intent is: (1) to broaden students' experience by having them communicate some of the scientific concepts they have learned to the general public through clear exposition and demonstration, and (2) to reinforce their sense of being part of the Science Centre by giving service to it.

Most of the students take advantage of this opportunity, the majority assisting with the OSCOTT program which provides instruction in short-term programs for children ranging in age from 3 to 15. A few take tours through the Centre, and some have travelled with what is fondly called "The Circus", which entails serving as hosts with touring exhibits.

The students really enjoy these voluntary activities. It is also apparent from their comments that the intent of this involvement is realized.

About OSCOTT they say:

- It was a riot; I love it; I enjoyed it; it was an interesting experience.
- It's good, it enriches the overall feeling of being part of the Centre.
- Really enjoyed it and learned a great deal about how to handle children, to keep their interest and answer their questions in terms they can understand. It developed my interest in being a teacher.
- Working with 4-5 year olds is a great learning experience. Also planning has to be done for each program which requires organization and aids in self discipline.

The two students who acted as tour guides found the experience valuable and enjoyable. Those who served as hosts with the travelling exhibits had similar feelings and found it valuable with the additional bonus of getting to know some of the other science staff and the programs offered.

- It was marvellous. I learned a great deal about working with people and the people taught me a lot. I have since worked as a teaching assistant at a conservation centre and on a credit course in archaeology. The preparation I received in teaching with people along Science Centre guidelines and with the Science Centre educational philosophy (don't tell people the answer, help them find it themselves) has helped me a great deal.

- I enjoyed it very much - it made me feel more a part of the Science Centre.

Students who have not taken part in the host program mentioned three reasons for not doing so: (1) the need to work part time, (2) a lack of spare time and (3) a feeling that it was not appropriate for them though they recognize the value of the program.

Participation in Extracurricular Activities

Since these students are considered part of the Don Mills Collegiate student body they are welcome to participate in the school's extra-curricular activities. Some students have participated in team activities, such as basketball, swimming or cross country running, although none has persisted as it is too difficult to reach Don Mills in time for practice and the academic demands on their time are very great. The students are not happy about having to give up such activities and complain of lack of exercise, but consider that it is a fair trade-off, part of the price they have to pay for the quality and intensity of the program at the Centre.

On their own initiative students have organized a number of activities both in and out of the Centre, for example impromptu football games, car rallies, nature walks, painting the development lab, trips to various universities, publishing a year book, taking a CPR course, and singing in a choir, parties and picnics. The Design Centre staff has regular weekly volleyball games and students have an open invitation to take part.

A snowball fight outside the Centre after the first snowfall was reported with glee. The fact that the Security Staff did not intervene is appreciated by the students and enhances their sense of being treated as adults who are responsible for their own behaviour.

A number of students also continue their involvement in activities outside of school. They sing in church choirs, swim, study music, play volleyball, badminton, run, curl, climb rocks, serve as volunteers with organizations such as the St. John Ambulance Corps or the Royal Ontario Museum, and work at part time jobs.

Semester Preference

Semesters are scheduled from September to January and February to June. Most students were comfortable with the semester they attended as they believe it makes no difference in what they learn.

For the first class of students, in September 1982, there was a sense of being pioneers, of being special.

- I think that our semester was special since we were all new, even the school. So we overcame many problems and as a result we have an important bond.
- I enjoyed being a member of the first group at the Centre and I wanted to spend my final semester in high school as my home school.
- I like to be the first in anything and here I found it beneficial as we were the ones who forced them into making the rules and we were the guinea pigs.
- Fewer rules had been created, the best government being the one that governs least.

Those who prefer the first semester list the following reasons:

- The people in the group are terrific! For this reason I would choose the same semester. Also, the timing fits in nicely; second semester would run into activities at my old school which I very much want to participate in.
- I'm more energetic and motivated in the first semester.
- I want to spend the final semester at my school and get the difficult semester over with.
- When I leave here I will be returning to a county where there are no semestered schools and I hope to combine correspondence with the second half of the year. At my old school this would not be possible if I had attended second semester.
- The other courses I want are offered second semester at my old school. Also our band is planning a major trip second semester. ...I would like to apply my "new" skills in the second semester.
- It gives you a chance to retake courses if necessary.

In defense of a preference for the second semester students told us that:

- Having experienced such a program I would not like to return to an ordinary high school where the limitations are so great.
- It was a great way to finish off my last year of high school. I would find it extremely difficult in readjusting to high school for the environment is completely different from the Ontario Science Centre.
- While I could have taken what I had learned about interaction with staff and students as well as academic approach back to a regular school I am afraid I would have found the transition disappointing ... if I had to return to the spoon feeding, memorize and be tested and detested atmosphere of most schools.

Those who would prefer a different semester said:

- I would rather end my schooling at O.S.C.S.S. rather than go back to a normal school when I'm finished.
- I know I will be unhappy in the structured system to which I will be returning.
- The program is a great preparation for university and when I have to go back to high school I think it will be a step backwards.
- I would rather spend the final semester at my home school.

The Screening Process

Students feel positive about the screening process. They like the idea that admission to the school is not based solely on high marks but is also dependent on personality, interest and ability to communicate.

Most students appreciate the opportunity of having a personal interview though they admit to being nervous. Some would prefer smaller groups or even individual interviews: "By the time they got to me everybody had already said what I wanted to say." They are delighted that students are involved in the selection process and that they have a opportunity to meet some of the other applicants. "When I got here I already knew some of my classmates. This would never happen at my home school."

The only problem they mentioned with respect to the screening process is that out-of-town students must come for the interview at their own expense.

Would they Recommend School to Friends?

Most would recommend the school to friends, the only caveat being that it is not suitable for everyone. They see survival there as dependent not only on interest in science and high motivation, but on the possession of an outgoing personality, and the ability to get along with people. "It wouldn't work for the Einsteins, the loners who work best by themselves."

Affect on Future Plans

Whether or not the students have a clearer sense of what they want to do in the future as a consequence of their attendance at OSCSS is dependent on how committed they already were to a career in science.

Those who say being at the Science School has not affected their future plans (20%) either were already very sure of what they want to do or have no concrete plans as yet.

For those who sense some affect on their thinking (47%), a few had already decided and are now more certain about what they want to do; some know they're interested in science but are not sure of the specific area; others have begun to see new options, e.g. research instead of medical practitioner, and one student has changed direction saying: "Before the program I had totally opted out of the sciences for the future but have since reconsidered."

For the remaining third who see their involvement in the Centre school as having a very strong influence on their future plans:

- The school has provided a positive and creative way of learning science and fostered an interest in research.
- It has shown me my ability in several areas and broadened my perspective; helped focus my interests.
- Provided good counselling which reinforced my interest in science and helped me sort out what I was going to do, although I made decision myself.
- Showed me some new directions, e.g. science communication, biomedical engineering, analytical chemistry.
- Reinforced previous ambitions but made me think about the future more and realize limitless opportunities available.
- Realize I love to work with people and pure research may not be the best idea for me.
- Had planned to study languages before; am now going to study genetics.

Experiences After the Centre

There is little doubt in the minds of most students that the growth they have experienced as a result of their attendance at the Science Centre School, both academic and personal, will affect their success in whatever they do. They speak of being better prepared to handle university studies because they have learned to be more questioning, inquisitive and creative in their thinking; have acquired better work habits and self discipline; and have a greater sense of responsibility. In terms of personal growth they feel more independent and self confident; have learned a good deal about how to handle interpersonal relationships; and are more willing to take risks since they feel they are more open to new challenges. Even the few who feel that their level of motivation, achievement and maturity before coming to the Centre would have assured them success in any event believe that: "It was a helpful and enriching experience though it's hard to say whether or not it has affected my academic success."

Former students who are now enrolled at university found little difficulty in making the adjustment. Most see their Science Centre School training as an invaluable preparation for university life.

- I feel that my adjustment to university has been made easier as I had been used to a lot of work, of which a lot was self taught. Thus I had become accustomed to depending on myself more than on teachers.

- It actually helps in preparing for university better than a normal high school.

On the other hand, a few of the students who returned to high school to complete grade 13 experienced somewhat of a let down after the high-paced learning they had experienced.

- High school seemed very dull and we actually had to readjust ourselves to structured teaching, classes. I was bored.

- When I returned to my home school I had to readjust to living at home (not too bad) and to taking subjects that weren't as interesting or easy as at the Science Centre.

- Returning to high school seemed too easy at first. I really missed the Science Centre atmosphere and even simple questions I asked were seen as an attempt to catch my teachers off guard when all I wanted was an answer.

- Going back to my home school has been hard because I feel I'm looked upon differently since I did go away to such a large place. This is a small school in a small town and people usually stay close to home if they can.

Concerns and Suggestions for Change

Though the positive experiences of students outweigh their concerns, they would like some changes made.

- They would prefer a longer period of secondment for teachers - "I don't like the idea of rotating teachers. It means they are learning with us instead of being ready for us. It's better to have experienced teachers."

- They would like better arrangements made so that needed supplies would be readily available.

- They would like to have study space and some exercise facilities.

They would also like this experience to be available to more people but not by enlarging the school which they feel would change the nature of interaction. They suggest that other centres be established instead. "Expansion would change the interaction and larger numbers would hurt the social benefit. Set up other centres instead."

A Parent's View

Some parents appear to be getting at least vicarious benefits from the school's existence. We received a call from one mother who was concerned that her son, who is currently studying abroad, would not be able to return his questionnaire in time. She told us that because he had attended a parochial school where there was little emphasis on science, not only did he learn a great deal at the Science School, but that she too benefited. "I could hardly wait for him to come home from school every day so that I could find out what he was learning."

Staff Views

Everyone else interviewed at the Science Centre, teachers, resource people and administrators, reinforced the impression given by the students that the school is successful in providing an exceptional educational opportunity. All who deal directly with the students speak in glowing terms of working with such bright and highly motivated students.

The Teachers' Perspective

There is no question that teaching these students is a labour of love. The teachers seconded from the Metro school boards say it is a rare experience for them to work with a group of students who are all highly motivated, interested in science, and who do well academically. The Science Centre staff, who usually teach short-term programs and are thus unable to see the effects of their teaching, enjoy the continued contact and the chance to see students' growth.

The Metro teachers apply to teach at the Science School because they feel it is an opportunity to work with interested science students in ways that aren't possible under normal classroom conditions because of the facilities and people available at the Science Centre. They also see it as useful in terms of their own personal and professional growth, since it is prestigious to have been affiliated with the Science Centre and it provides an opportunity to increase their understanding of how students communicate and how they perceive science.

Relationships with Students

The work with these students is rewarding for all the teachers because the nature and quality of interaction with them, both academically and personally, is quite different from that of regular high school. Students essentially design their own courses and are, therefore, involved in a considerable amount of independent study. More time is spent on a one-to-one basis with them, and "these kids don't go home at 4:00 o'clock". There is a much closer relationship between staff and students which requires more energy. Everyone is on a first-name basis which changes the dynamics of interpersonal relationships.

- The students see us as human beings for the first time and there is a trusting and friendly relationship between us.

Although the teachers recognize the skill and sensitivity of the Don Mills Guidance Head in providing counselling for students, particularly regarding post-secondary planning, they feel there is a need for more regular guidance services. While students are encouraged to discuss their personal or academic plans and problems with the teachers, the teachers sometimes feel they lack appropriate training to provide the help needed.

The teachers recognize that student peer support operates at a much more intense level than is the case in most schools.

. Recently, one student was thrown out of his home. His self image was very low and he was having a hard time at school. The kids rallied around him, recognizing his academic ability and laid into him in a very supportive way, telling him he can do the work and they will help because they care for him.

Course Content and Learning

Course content is not as different as the teaching staff had hoped since access to special equipment and Centre expertise has not been as readily available as anticipated. The method of learning, however, more than meets their expectations.

. In one sense we expect the same things of these kids as we do of any enriched class - to show independence and initiative. The difference here is that they are doing the science - looking at it in depth. They have to analyze and provide a rationale for everything they do.

Students have more responsibility for their own learning and are involved in deciding how they will be evaluated.

Availability of Centre Staff, Facilities, and Supplies

Budgetary restrictions have been fairly stringent at the Science Centre as for most other provincially funded institutions. Some of the teachers believe this has resulted in a change in priorities for the Centre. They feel that education, which has in the past been one of the primary goals of the Centre, has been overshadowed by a philosophy which now places more emphasis on the display of exhibits. They are concerned that this change in emphasis has had some effect on the resources which are available to the school, though not seriously enough to hamper the kind of learning being fostered.

Some staff are disappointed by the obstacles they encounter in the planning and sharing of facilities.

. It's great to be here but it's not all peaches and cream. The basic needs of students are not considered. We're asking them to do a lot more in an environment where it's more difficult. We take second place to all the other programs going on. The expertise we thought would be available is limited because the philosophy is that education is secondary, the Science Centre is primary. People who helped students in the past have been told not to this year. Students have to approach them on a catch-as-catch can basis which makes it much more difficult to use the expertise of the people here. Many of these people, nevertheless, are still generous with their time despite the interference with their regular duties, but it's a real waste not to have them more involved.

The maintenance and repair of equipment which is not being used for display purposes is given low priority and, consequently, students are not able to use some of this equipment, e.g. the gas chromatograph. Often, more time is spent on simple housekeeping because of the lack of appropriate space, e.g. the biology teacher has to set up experiments and demonstrations in three different labs.

Some difficulty is experienced because there is a shortage of adequate supplies and materials for carrying out the program, e.g. there is only one ph meter, and test tubes are in short supply. The teachers pay strong tribute to the skill exhibited by a former staff member who last year was responsible for organizing and obtaining needed materials. "The school would never have gotten off the ground without his help, because he knows the North York system". Since he has returned to his regular teaching duties there have been difficulties in obtaining the needed supplies and equipment.

Though the Chief of Education is responsible for the administration of the program, the teachers feel he is overburdened since, in effect, he carries two sets of full-time responsibilities. They suggest that one way to relieve him of some of the administrative burden is to assign responsibility for liaison with the Science Centre School to someone in a position of responsibility at Don Mills. Since the budget for supplies is provided through Don Mills, such an approach could facilitate the ordering of needed supplies.

- It will be difficult to continue on such an ad hoc basis. There is a need for leadership, for clear lines of responsibility for the physical operation of the school, someone responsible for ordering and maintenance of supplies and equipment, someone to go to when there is a problem.

Science Centre Duties

One condition of secondment to the Centre is that the teachers will contribute to the regular educational program of the Centre to compensate for the time given to the school by the three Science Centre teachers. Although participation in these programs requires time for preparation and presentation, these activities are not viewed as particularly onerous. For example, the chemistry teacher gives demonstrations in four programs, Fun with Chemistry, Computers, Robots and You, Science Fair, and Cryogenics, and the biology teacher has gone on tours with "The Circus".

Relationship with Science Centre Staff

There is a strong sense of good will, mutual admiration and respect among the teachers, and they seem very willing to work together and assist each other when needed. One minor source of frustration, however, is the lack of contact with other Science Centre staff. The teachers would like to have a greater sense of being part of a team.

Period of Secondment

All but one of the teachers think that the period of secondment should be extended to three years. They feel that it takes more than two years to get to know the people and the Centre well enough so that they can develop the kind of program they really would like to have. They would like a continuation of the system of having secondments overlap so that only one new teacher is introduced each year.

Length of School Program

Although the students speak of extending the program to two semesters, most of the staff believe that one semester is sufficient. Some teachers feel that a longer period would be too intense an experience and that it would be difficult for staff to maintain the high level of challenge.

Screening Process

As the screening process has only been in operation for a year and a half the staff feel it may be too early to judge its effectiveness. Essentially, they say, the students do a good job of screening themselves by deciding whether or not to apply. The teachers see the written application as particularly useful because it provides students with an opportunity to explain why they want to attend the school and gives them a chance to talk about themselves and their interests.

- The interviews are very effective and I expect we'll get better at it with more experience. The large group interview is hard on the kids; it makes them tense. You get to see their comfort level if you have both large and small group interviews. It also gives the kids a chance to ask questions.

Perceptions of Science Centre Resource Staff

As with everyone else who has contact with the students, the resource people, i.e. Centre scientists and technical staff, enjoy the experience and would like to have more time to work with them. They all see the students as intelligent, interested in learning and enjoying the environment.

- Students obviously get a lot out of being in a peer group. They stay late and have a high level of camaraderie. They also provide the best calibre of hosts for the Centre.

In the first year of the program some of the resource staff had as much as one-third of their time assigned to teaching duties. The skills of others were used on an ad hoc basis. This year there is no official assignment of time and access to resource staff has been more limited.

Resource staff provide assistance to students in a variety of ways.

- A member of the Chemistry Department, who is a specialist in instrumentation, gave a course on spectroscopy last year. He was also available to talk to students. This year he has lectured on chromotography.

- As part of the Communication course, one of the A.V. technicians taught a section on how to use audiovisual techniques. He also advised students on individual film making projects and on the use of video tapes and T.V. equipment. Though he thoroughly enjoyed working with the students, at times it meant putting in considerable overtime hours. He feels the need to have someone responsible for coordinating arrangements to borrow equipment needed.

- Also, as part of the Communication course, the Design Department arranged a presentation for students on the function of design in the Centre by means of a slide show which illustrated how exhibits differ from print as a means of communication of ideas. Members of the Design Department provide students with feedback on their design projects. Two of these were given floor space last year so that public reaction could be obtained. One of these projects used a small circulating pump to demonstrate the effect of pressure and the other, designed to demonstrate an aspect of acceleration, was placed in the elevator where it could be seen most effectively.

- Regular lectures and hands-on demonstrations on the use of the electron microscope are given by the lab head who describes how students make use of his facilities and how he feels about working with these students.

> For me it's been very good. I really enjoy working with these kids. I don't get a chance to know the other students who use the facilities as I see them for only one day. I have an open door policy here. Students come in and learn on their own. They learn microscopy in more detail because they have more time. They do their own projects. They would never have such an opportunity, even at university, as undergraduates don't have access to the electron microscope. They really gain a better appreciation for biology.

In addition to his other duties the electron microscope lab head has unofficially taken on the role of personal counsellor. The students like him because he is open and accepting and they are always welcome to drop in to his lab to talk. He feels it is important for the students to have a lounge for their own use.

The Librarian is also very welcoming and the library is open to students for study or as a place to relax. Despite the many demands made on her, she willingly takes the time to introduce students to the resources available - print, tapes, and film - and helps them to find reference material. Once introduced to the library facilities, the students usually look after their own needs. She finds the students cooperative, helpful, and mature. She indicated that she has a reasonable budget for new acquisitions and some of this money is available for school needs.

The shift in administrative policy, which has officially eliminated the time resource staff have to give to students this year, is frustrating for some of them. Students still approach them to ask questions and request supplies which places a strain on their time. Another source of frustration is the difficulty in getting equipment repaired or ordered if it is needed primarily for school use.

Some of the resource staff expressed concern about the pressure placed on the students by the lack of adequate space, the shortage of equipment and supplies, and the necessity for frequent rescheduling of classes. They feel the students need to have a greater sense of security about their physical surroundings since they are under considerable pressure from having to learn much in an unfamiliar environment. The students themselves did not appear as concerned and seem to view the lack of some basic things as a challenge to their adaptability and ingenuity.

The Perspective of Administrators

Interviews were held with representative administrators of the Science Centre - the Director General, the Chiefs of Education, Science, Design, and Finance, and the Senior Audiovisual Technician - as well as with the Principal and Guidance Head of Don Mills Collegiate. Though the interviews were fairly open-ended, there were common themes which dealt mainly with the administrators' perceptions of the effectiveness of the program, public awareness of the program, prospects for expansion, problems which exist and recommendations for change.

Effectiveness of the Program

There is general agreement among the administrators that the School is meeting the educational goals of the Science Centre as well as fulfilling their personal expectations of the program. They believe the school is very effective in providing a unique science enrichment program. Although most of these people have either limited or no direct contact with the students, they share an enthusiasm for the school. They are aware of the high level of academic achievement, manifest in the large number of scholarships and awards earned by the students (see Appendix G), and the personal growth which occurs there; they see the program as valuable preparation for university studies. In their perception, the success of the school is related to a combination of factors, the most important of which are:

1. The high calibre of students and staff-student relationships

   - They are very bright. It's lovely to have students who are not only with you but even ahead of you. The intellectual demands on us are good for the Centre staff.

   - There's nothing like a few young Turks at your heels to keep you on your toes.

   - They are young, inquisitive and enthusiastic.

   - The students have many other talents and skills besides mathematics and science.

   - The idea is wonderful. It's very positive to have young people around. They are a solid, cohesive group and operate in an environment where everyone is dedicated. The staff enjoy it too, and the students benefit because they are treated as adults.

2. The quality of the teaching staff and the learning experience

   - Nowhere else can students get this kind of experience. I have no concern about their getting an enrichment and core program as well as being forced to dig for themselves. I don't see them as being under a great deal of stress. The staff works hard to interpret their needs.

- The teachers provide creative, live programs for the students.

- The students are exposed to different possibilities for careers in science before they are locked into career decisions.

3. The availability of Science Centre resource staff

   - There are a lot of serious people with a wide range of interests who are sympathetic to young people. It is also a splendid place for exposure to multiculturalism because members of the staff speak many languages.

   - Several of the administrators lecture to the students each semester on topics related to their areas of expertise. The Chief of Education teaches the course on Science Communication. It's a valuable and enjoyable experience for us.

4. The availability of unique facilities

   - The equipment we have here is very different and would not be available in an ordinary school.

   - It's an excellent idea to have the facilities used more than they have been for educational purposes.

   - We can also use the exhibits as a means of teaching about non-print modes of communication.

Public Awareness of the Program

Several of the administrators believe there is little public awareness of the existence of the School, who it serves or how it is funded. They suggest that more attention be given to letting the public know about its existence and effectiveness.

- The program is not widely known, particularly by parents, and we need to see that it gets more publicity.

There is a feeling that increased public awareness, particularly on the part of parents, may help overcome the reluctance of some high schools to promote the program because they do not wish to lose some of their top science students and potential Ontario Scholarship winners.

Perception of Problems

The administrators are aware of many of the problems which the teaching staff mentioned - the lack of space, shortage of supplies, equipment in need of repair, the restricted access to resource staff, the need for better liaison between the Science School and Don Mills Collegiate regarding ordering of supplies, and the length of the period of secondment for Metro teachers. There are also additional pressures on Don Mills arising from a significant increase in record keeping, demands on the time of some staff members, and the occasional difficulty of collecting transfer fees from other school boards.

The concerns of students were also recognized. Without minimizing how students feel about the difficulties they encounter, the administrators believe that the students' ingenuity and adaptability are, in fact, challenged by the pressure on space and shortage of materials; that the anxiety which some students express about having to return to high school is not warranted as they are mature enough to make the transition without difficulty; and that it is not uncommon for many Grade 13 students to withdraw from extracurricular activities because of lack of time. They noted that the Science School students have organized many activities for themselves and continue to participate in various activities outside of school.

Some concern was expressed for the quality of communication between Centre personnel and the Science School and it was suggested that a regular series of meetings be held with staff and students and administrators to exchange ideas.

Expansion of the School

Few of the administrators believe that expansion of the school would be feasible at present. They are aware of the pressure on physical space at the Centre and the budgetary restraints placed on both the Centre and the Metro School Board. It was suggested instead that alternative modes of expansion be considered, such as the establishment of similar schools on a regional basis at other science centres in the province, e.g. Ottawa, London or Sudbury.

Among those who believe that some expansion would be either desirable or possible, there were suggestions that a bilingual program be included, a residential program be established, or that enrolment be increased to two classes a semester.

SUMMARY

There is a strong consensus that the school is a success in terms of the academic and personal growth of students. The unique environment, excellent staff, methods of teaching which stress inquiry, discovery and self-learning, and the very special and close relationships which are fostered there, encourage the kind of development in students which is much desired but rarely achieved in regular high schools.

The problems which exist are not considered serious enough to hamper the effective operation of the school. They are mainly related to the lack of physical space, the shortage of supplies, a need for better liaison between the school and Don Mills Collegiate, the length of the period of secondment for Metro teachers, and the financial constraints on the Centre which have limited the access to resource staff and some of the special equipment.

Various suggestions were made to either improve the operation of the school or to accommodate the felt needs of students and staff.

- Establishment of a position with responsibility for liaison between the Science School and Don Mills C.I., to be filled either by a member of the school teaching staff or by the Don Mills Science Head.

- Extension of the period of secondment of teachers to three years to allow for more effective delivery of program.

- Provision of guidance and counselling services at the Science School on a more regular and frequent basis.

- Assignment of adequate lab space so that teachers do not have to set up experiments and demonstrations in several places.

- Provision of space for a student lounge and study areas, and facilities and time for exercise.

- Increased publicity about the school, particularly for parents, so that more students are encouraged to apply.

- Improvement in communications with other groups within the Science Centre and with Don Mills C.I.

There is general agreement that the school should continue to exist though few feel it should expand given the current circumstances of shortage of space and funds. Establishment of similar, small schools at other science centres in the province is preferred, with the possibility of a component for French speaking students in areas with a large French population.

APPENDIX A

Ontario Science Centre Science School
Student Application Form

Please complete this form.

NAME _____
ADDRESS _____
_____
_____

BIRTH DATE _____ (YR) (MTH) (DY)
SEX _____
SOC. INSUR. NO. _____
IN CASE OF EMERGENCY, THE PERSON TO BE CONTACTED IS _____
PHONE NO. ( ) _____

PHONE NO. _____
PRESENT SCHOOL _____
SCHOOL ADDRESS _____
_____
_____

PRESENT SCHOOL BOARD _____
PARENT/GUARDIAN NAME _____
ADDRESS WHILE ATTENDING THE SCIENCE SCHOOL _____

List all the courses that you have taken in the last two years. Include your mark in the space provided. Please indicate the grade level.

SUBJECT	MARK	SUBJECT	MARK

Please show whether you agree or disagree with each of the statements by marking one of the spaces.

	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
I enjoy working with mechanical and scientific things.				
I enjoy abstract or mathematical problems.				
I like to work independently on projects.				
I enjoy debating or discussing an idea.				
I am able to come up with a number of ideas or solutions to problems.				
I am able to take charge of planning a project.				
I like to study subjects that are challenging or even difficult.				
I am able to accept constructive criticism from my peers.				
I am able to constructively criticize my peers.				
I feel strongly about things and often express myself, even though I think others will disagree.				
I enjoy talking to other people in a public forum.				

Please **write** something about **yourself** that you think the staff would be interested in reading so that the selection committee can get to know the **real you** before meeting you in person. For example, tell us about your hobbies, outside interests, work experience, and why you want to attend the science school.

PLEASE RETURN TO
Ontario Science Centre
SCIENCE SCHOOL
770 Don Mills Road
Don Mills, Ontario
M3C 1T3

Student's Signature _____

Parent's Signature _____

Date _____

Ontario Science Centre Science School
Staff Confidential Report

PLEASE NOTE: The student whose name appears on this form has applied to attend the Ontario Science Centre's science school. This form is the basis for a preliminary student selection by the school's staff and will significantly affect the student's opportunity.

STUDENT'S SURNAME _____ GIVEN NAMES _____

SCHOOL _____ STAFF NAME _____

SCHOOL BOARD _____ PHONE *(SCHOOL)* _____

Please indicate on a scale of **1** to **5** characteristics and behaviour exhibited by the student. Five indicates the student exhibits the characteristic most strongly.

	5	4	3	2	1
The student is liked and respected by the majority of the class.					
The student can take charge of the group in an activity.					
Has the ability to figure out what is wrong with an activity and show others how to improve it.					
The student seems to sense what others want and helps them to accomplish it.					
The student enters into things with contagious enthusiasm.					
The student has a number of ideas and solutions to problems, often offers unusual or creative responses.					
The student shows sensitivity to the needs of others.					
The student criticizes constructively.					
The student is able to accept constructive criticism.					
The student is clear and accurate in oral and written expression.					
The student tends to do more than required.					
The student rises above the failures met in experimentation or projects.					
The student wants to know the reasons and causes for things.					
The student appears to enjoy discussing scientific topics.					
The student is at ease in group discussion even if in a minority position.					
The student is at ease in discussing his or her work with strangers.					
The student is self-confident.					
The student is a divergent thinker.					
The student has a desire to achieve in science and mathematics.					

Please use the remainder of this form to make any pertinent comments about the student in relation to participation in the science school.

Staff Signature | Position

PRINCIPAL'S COMMENTS

Date | Principal's Signature

Ontario Science Centre
SCIENCE SCHOOL
770 Don Mills Road
Don Mills, Ontario
M3C 1T3

APPENDIX B

EVALUATION OF THE SCIENCE CENTRE SCHOOL

STUDENT INTERVIEW

1. What influenced you decision to apply to the Science Centre program?

2. In general, did you get/are you getting what you expected here? Please elaborate.

3. Was/is there anything very different from what you expected? Please explain.

4. What did/do you like best about the program?

5. What did/do you like least about the program?

6. Were you disappointed in any part of the program?

7. Are there any changes you would like to recommend:

   program

   staff

   facilities

   organization

   extracurricular activities

   use of time

   screening procedure

8. Do you think there are particular personality characteristics that students who are successful at the Science Centre School have?

9. How many extra hours do you put in, Saturdays, evenings, etc.?

10. Do you have a sense of being treated in more of an adult fashion here?

APPENDIX C

THE BOARD OF EDUCATION FOR
THE CITY OF NORTH YORK

5050 YONGE STREET • (WILLOWDALE) NORTH YORK
ONTARIO • M2N 5N8 • TELEPHONE 225-4661

TRUSTEES
[illegible]
DIRECTOR OF EDUCATION
SECRETARY TREASURER

2 December 1983

To All Former Science Centre School Students:

The Metropolitan Toronto School Board has been funding the Science Centre School for the past two years. They have asked for an evaluation to take place in order to determine the effectiveness of the program. It is most important that we hear from former students and we are asking for your co-operation in completing the enclosed questionnaire and returning it in the stamped self - addressed envelope by December 15, 1983. We would also like to conduct some random telephone interviews (requiring approximately 15 minutes) and will be telephoning some of you in the near future.

Your prompt return of the questionnaire would be greatly appreciated.

Sincerely,

Ron Broger
Principal
Don Mills C.I.

Gloria Broks
Consultant
Educational Research and
Evaluation Services

Patricia Crawford
Chief Research and
Evaluation Officer

GB/bw

THE BOARD OF EDUCATION FOR THE CITY OF NORTH YORK

EVALUATION OF THE SCIENCE CENTRE SCHOOL

STUDENT QUESTIONNAIRE

1. In terms of personal growth do you think you have benefited more or less than you would have if you had stayed at your home school?

   More ☐ Less ☐ No difference ☐

   If any change, please explain in what ways. _____

2. In terms of academic growth have you benefited by attending the Science Centre School?

   Yes ☐ No ☐

   If Yes, in what ways? _____

3. Has attendance at the Science Centre School changed your work habits?

   Yes ☐ No ☐

   If Yes, in what ways? _____

4. Do you have a clearer sense of what you'd like to do in the future as a result of your experience in the Science Centre program?

   Yes ☐ No ☐ Somewhat ☐

   Please elaborate. _____

5. Has your schooling at the Centre changed your thinking about the kind of career you'd like to pursue?

   Yes ☐ No ☐

   If Yes, Please explain. _____

6. Was/Is your work load different at the Centre from that in your home school?

Yes ☐ No ☐

If Yes, how? _____

_____

_____

7. Did/Do you experience much pressure regarding the amount/kind of work expected?

Yes ☐ No ☐

If Yes, where did/does it come from, (e.g. self, peers, staff, parents, environment, etc.) and how has this affected you?

_____

_____

8. Has your attendance at the Science Centre School changed the way in which you interact with fellow students?

Yes ☐ No ☐

If Yes, in what ways? _____

_____

_____

9. Did/Do you notice any difference in your interaction with your teachers since you have been at the Science Centre School?

Yes ☐ No ☐

If Yes, in what ways? _____

_____

_____

10. What is the nature of your interaction with other Science Centre staff?

_____

_____

11. In your perception is student interaction with other Science Centre staff generally positive?

Yes ☐ No ☐

If No, please explain. _____

_____

_____

12. Did you have any problems in terms of adjustment when you came here, e.g.

- ☐ homesickness
- ☐ difficulty in adjusting to Science Centre environment
- ☐ sense of displacement
- ☐ bewildered at first
- ☐ still bewildered
- ☐ missed friends
- ☐ lonely
- ☐ difficult to find a place to live
- ☐ transportation problem
- ☐ other _____

13. a) Which semester did you attend?

1st ☐ 2nd ☐

b) Based on your experience would you again choose the same semester?

Yes ☐ No ☐

Why? _____

_____

_____

14. Did/Do you attend scheduled classes regularly?

Yes ☐ No ☐

15. Is/Was there any change in your attendance pattern compared to that of your home school?

Yes ☐ No ☐

If Yes, what are the reasons? _____

_____

_____

16. a) Did/Have you take(n) part in any of the voluntary programs at the Centre, other than what was required by the Communications course?

Yes ☐ No ☐

If Yes, which ones? _____

_____

b) How do/did you feel about this kind of participation?

_____

17. a) Did/Have you participated in any extracurricular activities:

Please list

☐ organized by students _____

☐ outside of school _____

☐ at Don Mills C.I. _____

b) If you encountered any problems related to participation in extracurricular activities please describe what they were:

_____

_____

18. Were/Are there any courses which you found especially exciting in terms of learning, being exposed to new ideas, new ways of looking at the subject, etc.?

_____

Please explain why.

_____

_____

19. Following your Science Centre School experience, did you have any problems in adjusting to the return to high school or attendance at university?

Yes ☐ No ☐

Please specify _____

_____

_____

20. a) If you are attending university now, what courses are you taking?

_____

_____

b) Did your attendance at the Science Centre School influence your choice of subjects?

Yes ☐ No ☐

21. Do you think your Science Centre School experience has affected your success - academic or other.

Yes ☐ No ☐

In what ways? _____

_____

_____

22. Would you recommend the Science Centre School to a friend?

Yes ☐ No ☐

Please explain. _____

_____

_____

23. Any other comments you'd like to make?

THANK YOU FOR YOUR COOPERATION.

Please return no later than 15 December 1983

to: Research and Evaluation Services
5050 Yonge Street
Willowdale, Ontario
M2N 5N8

APPENDIX D

EVALUATION OF THE SCIENCE CENTRE SCHOOL

STAFF INTERVIEW

- Why did you apply to teach here?
- Does teaching in this program meet your expectations? Please elaborate.
- How do you feel about the 2 year period of secondment? What should it be and why?
- Is the curriculum different from that of your home school? If yes, in what way?
- Is your workload different from that of your home school? How?
- Are there any problems in integrating your teaching duties with your regular Science Centre responsibilities? If yes, please explain. What percent of your time do you spend on Science Centre duties? School?
- Is there a difference in the quality and/or quantity of student participation in the program here compared to your home school?

  (probe for - do they work harder, are they more curious, more involved in independent study; do they attend more regularly; complete assignments on time; is discipline a problem, other activities)
- Do you think the school is operated in keeping with the goals of the Science Centre?
- How well do you think the school prepares students for their future studies of careers? How do you think this is different from what would happen in their home schools?
- a) In your perception, do other Science Centre staff understand the purpose of this school? Elaborate.

  b) Are they supportive of the school? If yes, in what ways?
- Do you make use of Science Centre resource people. In what capacity
- Are the Science Centre resource people generally helpful and supportive of the program? Elaborate.
- Do you think that the experience gained in this special program is sufficiently different from regular secondary programs to justify the operation of the school? Elaborate.

  (probe for difference in curriculum, achievement, environment, extra-curricular activities, volunteer experience, etc.)
- If you were in charge of the program what changes would you make?
  - realistically
  - in an ideal world

APPENDIX E

EVALUATION OF THE SCIENCE CENTRE SCHOOL

RESOURCE STAFF INTERVIEW

Primarily an open interview with focus on:

- nature of contact with students
- perception of students
- effectiveness of program
- perceptions of problems
- changes recommended

APPENDIX F

EVALUATION OF THE SCIENCE CENTRE SCHOOL

ADMINISTRATOR

Primarily an open interview with focus on:

- how program affects Science Centre, e.g. image, public awareness, use of facilities
- staff interaction
- student-staff interaction
- cost related to benefit (human and material resources)
- administrative problems
- perception of success - is program meeting his own expectations?
- perception of problems
- changes recommended
- whether program is meeting the goals of the science Centre

APPENDIX G

SCHOLARSHIPS AND AWARDS WON BY
GRADUATES OF THE 1982-83 PROGRAM

		No. of Students
Ontario Scholarships		21
University Entrance Awards		
University of Toronto		7
Open Admission Scholarship	3	
Mary H. Beatty Admission Scholarship	2	
New College Wetmore Scholarship	1	
Manuel and Anne Belle Prisitz Scholarship	1	
University of Waterloo		1
Faculty of Engineering Entrance Scholarship		1
McMaster University Award of Merit Scholarship		1
Other Awards		
Geography Department	2	
Mathematics Department	1	
P. L. Robertson Mathematics Award	1	
Descartes and M.A.A. Mathematics Award	1	
Modern Languages (French) Award	1	
Staff Honour Awards	2	
Civitan Club Award	1	
Dow Family Scholarship	1	

NOTE: These are awards which have been reported. Not all former students have been heard from and the staff estimates that the number of Ontario Scholarships is probably closer to 24.

APPENDIX H

1982-83 GRADUATES

WHERE THEY ARE NOW

Attending University (37 in Canada, one at the University of Michigan and one in Israel)		39
Major area of study		
Engineering	14	
Science	7	
Premed, Nursing, and Veterinary Science	8	
Arts and Science	10	
Completing Grade 13		5
Working with intent to attend university next year		3